

National Recovery Plan for the Variegated Pygmy Perch *Nannoperca variegata*

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Government of South Australia
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and Heritage



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and Environment

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This Recovery Plan has been developed with the involvement and cooperation of a range of stakeholders, but individual stakeholders have not necessarily committed to undertaking specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the plan due to changes in knowledge.

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Summary

The Variegated Pygmy Perch *Nannoperca variegata* is a small freshwater fish endemic to south-eastern Australia, where it occurs in a very restricted area in south-eastern South Australia and south-western Victoria. The species is listed as Vulnerable under the Australian Government *Environment Protection and Biodiversity Conservation Act 1999*, and is also designated as Vulnerable on the IUCN Red List of Threatened Animals (IUCN 2006) and the Australian Society for Fish Biology 'Threatened Species List' (ASFB 2001). In Victoria the Variegated Pygmy Perch is listed as Threatened under the *Flora and Fauna Guarantee Act 1988*, and is considered Endangered (DSE 2003). In South Australia the species is protected under the *Fisheries Act* (1982) and has been listed as Endangered (Draft Threatened Species Schedules of the *National Parks and Wildlife Act 1972*).

It is likely that the Variegated Pygmy Perch has suffered a significant decline in abundance due to habitat changes to rivers and creeks through habitat alteration and groundwater extraction. This decline appears to be continuing, as at least one population has become extinct in recent decades. Major threats to Variegated Pygmy Perch include wetland drainage and groundwater extraction, climate change, habitat damage through grazing and lack of regeneration, and introduced fish competitors and predators. This is the first national Recovery Plan for the Variegated Pygmy Perch, and details its distribution, habitat, conservation status, threats, and recovery objectives and actions necessary to ensure its long-term survival.

Species Information

Description

The Variegated Pygmy Perch *Nannoperca variegata* is a small perch-like member of the family Percichthyidae that attains a total length of 65 mm. The Variegated Pygmy Perch resembles the more common Southern Pygmy Perch *Nannoperca australis*. It has an oblong, compressed body, a single deeply-notched dorsal fin and a lateral line which is divided into two parts. The dorsal head profile is curved and the mouth relatively small and terminal. Colouration varies from bright green or olive above, to tan or light brown on the sides grading to a whitish or orange belly, with the upper part of the head, back and pectoral region golden, a dark spot on the base of the caudal fin, and a series of midlateral dark blotches (description from Kuitert & Allen 1986; Allen 1989; McDowall, 1996).

The Variegated Pygmy Perch is a free-swimming species normally closely associated with submerged and emergent aquatic vegetation. The entire life cycle is completed in freshwater, although it can tolerate slightly brackish waters. Primarily carnivorous, aquatic insects and benthic microcrustaceans comprise the bulk of its diet (Allen 1989). Variegated Pygmy Perch spawn from spring to early summer, however very little else is known of the breeding biology of this species in the wild. It is assumed that breeding behaviour is similar to the Southern Pygmy Perch, that lays demersal, non-adhesive eggs over submerged aquatic vegetation and the substrate.

Distribution

The Variegated Pygmy Perch has a very limited distribution within south-eastern Australia, being restricted in Victoria to the Glenelg River system in the far south-west, and in South Australia to the Ewans and Piccaninnie Ponds systems, and the Eight-Mile Creek system, in the far south-east of the State (Figure 1).

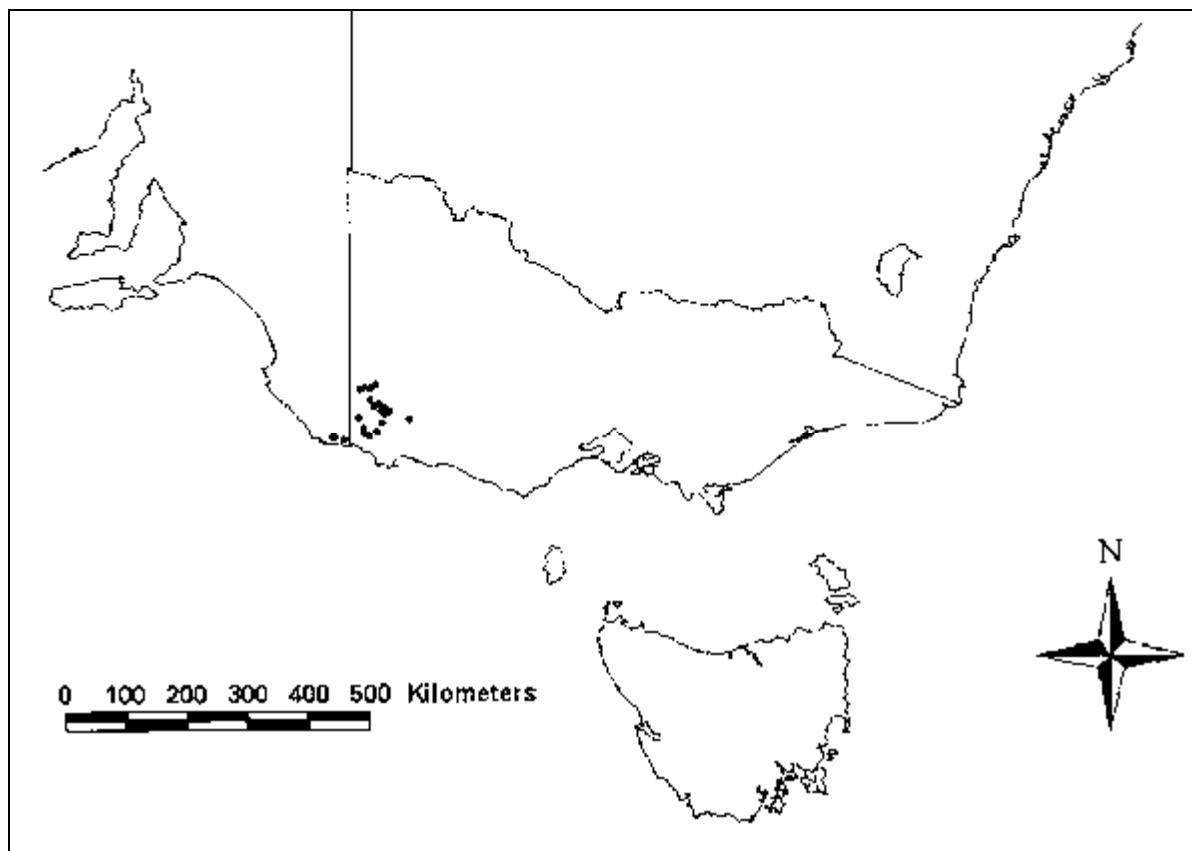


Figure 1. Distribution of the Variegated Pygmy Perch in south-eastern Australia.

Habitat

The preferred habitat of the Variegated Pygmy Perch includes relatively shallow freshwater streams with moderate to high water flow. This is in contrast to the other *Nannoperca* species that are often found in slow moving pools or lentic wetland environments. The Variegated Pygmy Perch is also strongly associated with high levels of submerged and emergent aquatic vegetation (Saddler, pers.obs, Hammer, 1992) and has a preference for clear water (Allen 1989). It can be found in fresh and slightly brackish waters, mostly over substrates of gravel, cobble or boulder in the absence of silt, although at Ewens Ponds in South Australia it is associated with large amounts of detritus (Kuiter *et al.* 1996). In the wild it can tolerate a temperature range of 14–26°C and a pH range of 6.8–7.5, with captive specimens surviving best in water temperatures of 18–27°C, a pH of 7.2 (Armstrong 1998) and well oxygenated water (Kuiter & Allen 1986).

Variegated Pygmy Perch are usually found in small groups, often mixed with Southern Pygmy Perch and Yarra Pygmy Perch *Nannoperca obscura*, although the Variegated Pygmy Perch prefers faster water velocities than the other two species (as was observed in the Ewen's Ponds system where *N. variegata* was most abundant in the faster flowing channels linking the ponds, whereas *N. australis* was most abundant in the pool habitat (Kuiter & Allen 1986).

Population Information

The Variegated Pygmy Perch has been recorded from 20 locations within Victoria and South Australia (Appendix 1). Total population number is not known. Some populations are tiny, such as the '54-foot' pond population in South Australia, where only two specimens were recorded. Others are quite extensive, occurring in permanent waterways such as the Glenelg and Wannon rivers in Victoria. Up to 187 individuals have been captured from a 100 metre length of the Grange Burn Creek in Victoria (Saddler, unpubl.). Of these 20 populations, only two occur in some form of reserve (Ewen's Ponds and Piccaninnie Ponds Reserves, South Australia), while the remaining 18 populations occur on private land, generally utilised for grazing purposes. Few populations have been re-surveyed since their original discovery, and their current status (particularly in Victoria) is largely unknown.

Populations have been ranked for management priority, on the basis of one or more of the following criteria:

- Populations at the extremes of the range.
- Populations are of a high density.
- Populations are isolated within their range from other populations.
- Populations are in an area of high conservation significance (eg. conservation reserve, in 'Directory of Important Wetlands').
- Populations of other threatened fish species occur at the site.

Decline and Threats

The Variegated Pygmy Perch was only described in 1986 (Kuitert & Allen 1986), so there is no historical information on distribution or abundance. As few of the known populations have been re-surveyed since they were first discovered, current population persistence and trends are largely unknown. However, there is an assumption that due to the fragmented distribution of known populations (and the trends observed in the closely related and threatened Yarra Pygmy Perch), the Variegated Pygmy Perch has also suffered from habitat fragmentation and loss, especially in South Australia. The species is believed to be a short-lived species and probably has poor dispersal ability. The fragmented and patchy nature of its remaining habitat across the landscape, and variability of this habitat between seasons and years, makes the species extremely vulnerable to local extinctions. Reduced flooding and loss of habitat linkages greatly reduce the ability to recolonise habitats.

The major current and suspected threats are detailed as follows:

Degradation and loss of habitat

The nature of the lowland, shallow freshwater habitat of Variegated Pygmy Perch means it is especially susceptible to a range of practices that result in its degradation and loss, especially where this habitat occurs on private land. The extraction of groundwater, particularly in the south-east of South Australia is a clear threat to the ecological sustainability of the significant habitats and species of coastal springs in these areas (Hammer 2002), as well as in Victoria. Apart from the direct loss of habitat, lateral connectivity to wetlands is also reduced. This connectivity is important for maintaining the life cycles of macroinvertebrates and aquatic plants, and consequently for species such as Pygmy Perch that rely on these associations.

Many sites on private property are threatened by damage from unrestricted stock access. Stock access and trampling has a major impact on waters where Variegated Pygmy Perch are found through disturbance and removal of instream and riparian habitat. Physical damage to instream vegetation directly removes a key habitat component. A reduction in riparian vegetation quality generally results in a decrease in water quality through increased nutrient run-off and a reduction in bank stability which leads to increased erosion and sedimentation. Sedimentation has direct effects on fish including asphyxiation, the smothering of eggs, a reduced ability to find food and the smothering of stream beds which leads to a reduction in habitat and flows. Additionally, sedimentation reduces the level and diversity of aquatic macroinvertebrates and plants (DSE 2007b), factors considered critical components of Variegated Pygmy Perch habitat. Degraded riparian vegetation also leads to a decrease in organic input. Macroinvertebrates (a major dietary component of Variegated Pygmy Perch) require this organic input as a nutrient source. Decreased overhanging vegetation also leads to increased summer water temperatures which in turn may lead (particularly when combined with increased nutrient input) to algal blooms. Further physical disturbance of smaller waters may also occur through practices such as drainage and ploughing after water levels are reduced.

Alteration to flow regime

Apart from the direct effects of groundwater extraction, alteration of natural flood and drying cycles, particularly in shallow creeks, through activities such as catchment clearing, establishing extensive plantations or construction of dams, pose threats to Variegated Pygmy Perch habitat. These activities may alter natural seasonal water levels at critical times of the year or may result in complete loss or permanent alteration of more shallow habitats. Populations occurring in smaller creeks on land where grazing is practiced (constituting the majority of known sites) are particularly susceptible to water abstraction for stock watering.

Extensive plantations of eucalypts and pines in south-eastern South Australia and south-western Victoria pose a major threat to habitat through lowering ground water levels and decreasing runoff into

waterways. More wide-scale clearing of catchment vegetation may lead to elevated agricultural run-off that may directly affect water quality (through increased input of sediment, pesticides/herbicides etc) or increase the risk of algal blooms through increased water nutrient levels and sedimentation. Catchment clearing and subsequent tree plantation establishment are also likely to cause altered hydrological regimes (Vertessy *et al.* 2000) resulting in reduced catchment water yield and direct aquatic habitat loss.

Climate change

Climate change poses a substantial medium to long term threat to the survival of the Variegated Pygmy Perch. A predicted major impact of climate change in south-eastern Australia will be a decline in overall rainfall, increasing temperatures, and increasing evaporation, with subsequent increasing dryness (Pittock 2003). This scenario is expected to result in a reduction in the shallow freshwater habitats favoured by the Variegated Pygmy Perch through increased drying and decreasing flooding cycles. Decreased flooding will also decrease chances of recolonisation after local extinctions, further fragmenting and isolating remaining populations.

Introduced Aquatic Species

Predation by Redfin Perch *Perca fluviatilis*, Brown trout *Salmo trutta* and Rainbow trout *Oncorhynchus mykiss* may be implicated as a factor contributing to the decline of Variegated Pygmy Perch (Wager & Jackson 1993). Specimens of Southern Pygmy Perch have been identified in the stomach contents of Redfin Perch (S. Saddler, pers. obs.), suggesting that the Variegated Pygmy Perch may also be a target for Redfin Perch predation. Damage to aquatic vegetation by Common Carp *Cyprinus carpio* may also impact on habitat critical to the survival of this species while competition/aggressive behaviour (particularly from Eastern Gambusia *Gambusia holbrooki*) are also implicated in the decline of this species (Wager & Jackson 1993).

Illegal collection

Although there is no direct evidence of the unauthorised collection of Variegated Pygmy Perch in Victoria or South Australia, the collection of small threatened species by aquaculture enthusiasts has been flagged as a potential problem for the closely related species, the Oxleyan Pygmy Perch *Nannoperca oxleyana* (NSW DPI 2005). While no direct evidence exists for the collection of Variegated Pygmy Perch, notes on the husbandry of this species in aquaria are readily available in web based publications, suggesting that collection to some degree may be occurring. The random collection of individuals for aquariums is likely to be harmful to small, restricted populations of this species (NSW DPI 2005). Additionally, this unregulated collection and trading of individuals by enthusiastic aquarists has the capacity to undermine the genetic integrity of natural populations if specimens are released back into the wild into areas other than those in which they were collected from.

Populations Under Threat

Virtually all populations of Variegated Pygmy Perch are under threat to some degree. The type of threats applying to particular populations depend largely on land tenure and management, with populations on private land most at risk. Only two populations occur in some form of reserve, both within South Australia. The majority of known populations (28) therefore occur at sites that have little or no formal protection from many of the threats listed, and those that do are exposed to broader threats affecting shallow freshwater habitats.

Recovery Information

Program Implementation

The Recovery Plan will run for five years from the time of adoption of a Final Plan, and will be managed by the Department of Sustainability and Environment (Victoria) and the Department for Environment and Heritage (South Australia), who will maintain liaison with each other over implementation. Implementation of individual actions will remain the responsibility of the relevant agencies and organisations identified in the Recovery Plan (subject to available resources), who will be responsible for obtaining resources, preparing work plans and monitoring progress toward recovery within their own jurisdiction.

Program Evaluation

This Recovery Plan will be reviewed within five years of the date of its adoption under the EPBC Act.

Recovery Objectives

The long-term objective of recovery is to minimise the probability of extinction and ensure long-term survival of Variegated Pygmy Perch in the wild and to increase the probability of important populations becoming self-sustaining in the long term. Within the life span of this Recovery Plan, the **Specific Objectives** of recovery are to:

- Determine the distribution and abundance of the Variegated Pygmy Perch.
- Determine the genetic and taxonomic status of Variegated Pygmy Perch populations.
- Determine Variegated Pygmy Perch habitat characteristics and requirements.
- Identify and manage potentially threatening processes impacting on Variegated Pygmy Perch conservation.
- Protect key populations across the range of the Variegated Pygmy Perch.
- Determine population trends at key sites.
- Investigate key aspects of biology and ecology of the Variegated Pygmy Perch.
- Establish a captive breeding population of Variegated Pygmy Perch.
- Undertake translocations to establish new populations of Variegated Pygmy Perch.
- Undertake community education and communication to increase awareness and involvement.

Recovery Objectives, Performance Criteria and Actions

Recovery Objective	Performance Criteria	Actions
1. Determine the distribution and abundance of the Variegated Pygmy Perch.	Increases in knowledge of population numbers and distribution in all regions.	1.1 Develop targeted survey techniques. 1.2 Undertake field surveys and mapping in Victoria and South Australia.
2. Determine the genetic and taxonomic status of Variegated Pygmy Perch populations.	Understanding of population genetic and taxonomic partitioning, and information incorporated into recovery management.	2.1 Determine levels of genetic partitioning between populations and regions. 2.2 Determine taxonomic implications of population partitioning.
3. Determine Variegated Pygmy Perch habitat characteristics and requirements.	Habitat use at different life history stages and across total range determined, and information used for recovery management.	3.1 Investigate habitat requirements at different life history stages and across total range and determine habitat critical to survival. 3.2 Develop and test a predictive habitat model. 3.3 Develop management strategies to maintain, enhance or restore essential habitat requirements.
4. Identify and manage potentially threatening processes impacting on Variegated Pygmy Perch conservation.	Increasing understanding and effectiveness of threat abatement so that there is an increase in the numbers of animals and area of occupancy of target populations.	4.1 Identify current and potential threats at each population site. 4.2 Prepare threat abatement plan for all priority sites. 4.3 Prioritise protection and restoration of habitat at sites supporting Variegated Pygmy Perch populations. 4.4 Implement threat abatement plans for all known sites
5. Protect key populations across the range of the Variegated Pygmy Perch.	Key Variegated Pygmy Perch populations are identified and protected across all bioregions and incorporating the genetic/taxonomic variation of species.	5.1 Protect populations on public land/waters by negotiating Public Authority Management Agreements under the <i>FFG Act</i> (1988) and Special Protection Zones in State Forest (Vic), as well as negotiating land covenants under the S.A Sanctuary Scheme (DEH). 5.2 Liaise with statutory bodies responsible for the management of water affecting Variegated Pygmy Perch populations to ensure species requirements are considered during planning and management activities. 5.3 Protect populations on private land/waters by initiating private land management agreements in consultation with private land-owners under the <i>Victorian Conservation Trust Act</i> 1972 and Land for Wildlife program (Vic) and the Heritage Agreement Scheme and Sanctuary Scheme in South Australia. 5.4 Liaise with landholders whose land borders or lies immediately upstream of Variegated Pygmy Perch populations to encourage appropriate protection and general awareness of species requirements.

6. Determine population trends at key sites.	A network of monitored populations is established and long-term monitoring of population trends undertaken to assess the impact of threats and effectiveness of recovery actions.	<p>6.1 Develop standardised population monitoring techniques.</p> <p>6.2 Establish a network of sites within each bioregion where population monitoring will occur.</p> <p>6.3 Conduct population monitoring at selected sites to investigate recruitment/mortality levels and determine population viability.</p>
7. Investigate key aspects of biology and ecology of the Variegated Pygmy Perch.	Information on key aspects of biology and ecology is gained and used in conservation management of the species.	<p>7.1 Determine the conditions for spawning and recruitment of the Variegated Pygmy Perch.</p> <p>7.2 Determine the diet of the Variegated Pygmy Perch.</p>
8. Establish a captive breeding population of Variegated Pygmy Perch.	Variegated Pygmy Perch successfully established at one or more locations in captivity, breeding and recruiting young.	8.1 Establish and maintain populations in captivity (eg. zoos, aquaria, universities, institutes) to safeguard against loss of wild populations and genetic diversity.
9. Establish new populations of Variegated Pygmy Perch.	At least one new demographically robust population established in secure habitat.	<p>9.1 Evaluate and select suitable translocation sites.</p> <p>9.2 Prepare a translocation plan and protocols to ensure appropriate genetic diversity in translocated populations.</p> <p>9.3 Prepare site(s) to achieve maximum survival of translocated individuals and implement translocation plan.</p> <p>9.4 Maintain and monitor translocated populations.</p>
10. Increase awareness and involvement.	Community and stakeholder understanding of and support for Variegated Pygmy Perch conservation is increased.	<p>10.1 Identify opportunities for community involvement in the conservation of the Variegated Pygmy Perch.</p> <p>10.2 Provide information about threats to and recovery management of the Variegated Pygmy Perch to land and water managers, other stakeholders and the general public.</p>

Cost of the Recovery Plan

The estimated cost of implementing the Recovery Plan is \$1.24 million over five years.

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Totals	\$44,000	\$153,950	\$266,118	\$407,155	\$367,515	\$1,238,738.00

See Appendix 2 for detailed costs by Action and by Year.

Benefits to other species/ecological communities

The Recovery Plan includes a number of potential biodiversity benefits for other species and ecological communities known to co-occur with Variegated Pygmy Perch populations (Appendix 3). Of particular importance is the potential benefit to other threatened fish species such as the Yarra Pygmy Perch and Australian Grayling *Prototroctes maraena* (both nationally threatened species). A number of other protected species will benefit from actions under this Recovery Plan, including the Southern Pygmy Perch and Freshwater Blackfish *Gadopsis marmoratus* (both species protected in South Australia under the *Fisheries Act 1982*). Principally, this will be through the protection and management of aquatic and riparian habitat where Variegated Pygmy Perch occur and on adjacent land. The adoption of broad-scale management techniques and collection of baseline data will also benefit other aquatic species occurring in association with Variegated Pygmy Perch, particularly those species with similar habitat requirements and life cycles. In addition, implementation of the recovery plan will increase public awareness of this and other freshwater species and their conservation requirements.

Additional fish species recorded from sites where Variegated Pygmy Perch are found will also benefit from conservation measures aimed at conserving this species. Many of these species are migratory, requiring access to estuaries or the marine environment to complete their life cycle. These species include the Tupong *Pseudaphritis urvillii*, Common Galaxias *Galaxias maculatus*, Spotted Galaxias *Galaxias truttaceus*, Short-headed lamprey *Mordacia mordax* and Short-finned Eel *Anguilla australis*. Many non-migratory species will also benefit from these actions, including Flat-headed gudgeon *Philypnodon grandiceps* and Australian Smelt *Retropinna semonii*.

The Recovery Plan will also provide an important public education role as threatened fish have the potential to act as 'flagship' species for highlighting broader nature conservation issues in aquatic habitats, such as habitat degradation, barriers to migration and the effects of invasive species.

Role and interests of indigenous people

Indigenous communities on whose traditional lands the Variegated Pygmy Perch occurs are being advised, through the relevant regional indigenous facilitator, of this Recovery Plan and invited to provide comments. Indigenous communities will be invited to be involved in the implementation of the Recovery Plan.

Affected Interests

The Variegated Pygmy Perch occurs across a variety of land/water tenures and managers. Consequently, management is the responsibility of a range of agencies, organisations and individuals (Table 1). Populations are considered reserved if they are contained within parks/reserves or other protected areas established with nature conservation (as defined under relevant state/territory legislation) as a primary or major aim of management (eg. in national and state parks, nature reserves etc.).

This Recovery Plan has the support of State/territory government agencies, land/water managers including Catchment Management Authorities, Melbourne Water and community groups involved in nature conservation in general and native fish conservation in particular (eg. Native Fish Australia).

Table 1. Affected Interests

Organisation	Type
National/Regional	
WWF – Threatened Species Network	Community Group
Australia and New Guinea Fish Association	Community Group
Native Fish Australia	Community Group
South Australia	
Dept. of Environment and Heritage	State Government
South Australian Research and Development Institute	State Government
Dept. of Water, Land and Biodiversity Conservation	State Government
Conservation Council of South Australia	State Government
Department for Water Resources	State Government
South East Catchment Management Board	State Government
South Australian Environmental Protection Agency	State Government
PIRSA Fisheries	State Government
Forestry SA	State Government
SE Water Conservation and Drainage Board	Regional Authority
South Australian Recreational Fishing Advisory Council	Community group
Native Fish Australia (SA)	Community group
Landcare South Australia	Community group
Victoria	
Department of Sustainability and Environment	State Government
Department of Primary Industries	State Government
Victorian Environmental Protection Agency	State Government
Glenelg-Hopkins Catchment Management Authority	Regional Authority
Glenelg Shire Council	Local Government
Victorian Threatened Species Network Coordinator	Community group

Social and Economic Impacts

The implementation of this Recovery Plan is unlikely to cause significant adverse social and economic impacts, although there may be low-level impacts associated with protection of populations on private land. Because most populations are on private land, habitats potentially affected by the impacts of riparian clearing, drainage, stock access or water abstraction may require controls on their use. For this reason, potential negative on-farm impacts may include foregone grazing, and costs associated with fencing and establishing alternative watering points (LWRRDC 1999). However, affected areas are likely to be generally small. There are substantial benefits associated with improved riparian management, including improved stock control, opportunity for income diversification (farm forestry in riparian zone), improved water quality, reducing stream bank erosion, improved aesthetics, improved farm biodiversity and improved farm capital value. Protection on private land will be achieved through negotiation with land owners/managers. Incentives are available through natural resource management programs, and protection of habitat for the Variegated Pygmy Perch will be included as an objective in high priority areas.

Management Practices

The condition of the riparian zone surrounding waters where the Variegated Pygmy Perch occurs is critical to the survival of this species, as is the condition of the aquatic vegetation within the waterbody. Appropriate hydrological conditions are also considered of vital importance, with the draining of wetlands being attributed for the loss of a number of populations of this species (Hammer, 2002). Hydrological conditions also affect the natural level of wetland connectivity (where Variegated Pygmy Perch are often found) to more permanent waterbodies such as rivers or creeks. Maintaining this connectivity is vital to the long-term survival of this species (particularly during extended dry conditions) and must therefore be considered as a critical habitat requirement. Management practices that should

be adhered to by land and water managers in order to avoid threatening processes believed to be responsible for the decline in the Variegated Pygmy Perch include:

- No direct loss of habitat through wetland drainage on either public or private land.
- No physical alteration to Variegated Pygmy Perch habitat as a consequence of incidental works on land adjoining Variegated Pygmy Perch habitat.
- Applications for water abstraction or dam construction do not compromise flow regimes for Variegated Pygmy Perch.
- Habitat and adjoining riparian habitat are fenced off to stock access.
- Off-stream watering points are provided for stock.
- No further damage to riparian vegetation.
- Damaged or depleted riparian vegetation is protected and (if necessary) supplemented by active revegetation works.
- Plans to clear vegetation lying adjacent to Variegated Pygmy Perch habitat will not impact upon water quality (no increase in sedimentation/nutrient levels/pesticides/herbicides etc).
- Plans to revegetate with plantation timber/crops will not impact upon overall water yield (and subsequently flow regime of Variegated Pygmy Perch habitat).
- Proposals to translocate aquatic species into Variegated Pygmy Perch habitat are subject to relevant risk management processes according to relevant national and State guidelines.

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Appendix 1. Population location information for the Variegated Pygmy Perch

Sources: DSE 2004; Hammer 2002

State	Location	Catchment	Bioregion*	Abundance (N fish/ 100m) V. Low <6 Low 6-10 Med 11-20 High 21-30 V. High >30	Surveyed Year methods D Dip net S Seine net B Bait trap L Light trap E Electrofishing R Rotenone	Comments/(Land tenure-Land Manager)	Mgt Priority	Zone	Easting-Northing
VIC	Glenelg River	Glenelg River	NCP	(4-31)	1994 (E)	Private	1	54H	0521400-5825800 to 0552600-5886100
VIC	Wannon River	Glenelg River	NCP	V Low-Med (1-15)	1994 (E)	Private	1	54H	0539100-5837800 to 0558300-5831100
VIC	McRae Creek	Glenelg River	NCP	High (27)	1994 (E)	Private	1	54H	0552300-5822800
VIC	Merino Creek	Glenelg River	NCP	High (23)	1994 (E)	Private	1	54H	0548000-5825400
VIC	Miakite Creek	Glenelg River	NCP	High (26)	1994 (E)	Private	1	54H	0552300-5822800
VIC	Crawford River	Glenelg River	NCP	V. Low-V.High (3-55)	1990/4	Private	1	54H	0528700-5801200 to 0539000-5800700
VIC	Glenaulin Creek	Glenelg River	NCP	V High (62)	1983/84/85/86/90 (D/E)	Private	1	54H	0527800-5799900
VIC	Grange Burn Creek	Glenelg River	NCP	V High (187)	1994 (E)	Private	1	54H	0579400-5825900
VIC	Little Glenaulin (Horse) Creek	Glenelg River	NCP	Low (7)	1990 (E)	Private	1	54H	0532900-5794700
VIC	MacPhersons Creek	Glenelg River	NCP	V High (31)	1994 (E)	Private	1	54H	0535400-5848000
VIC	Salt Creek	Glenelg River	NCP	Med (18)	1990 (E)	Private	1	54H	0519300-5870000
VIC	Stokes	Glenelg River	NCP	V. Low-High (1-30)	1990/94 (E)	Private	1	54H	0526300-5807800 to 0546600-5816200
VIC	Wennicott Creek	Glenelg River	NCP	V Low (3)	1990 (E)	Private	1	54H	0548600-5837200
SA	Stratman's Ponds	Eight-Mile Ck	NCP	V-High (56)	2001-2	Fenced	1	54H	0479600-5789800

SA	54-foot Pond	Eight-Mile Ck	NCP	V-Low (2)	2001-2	Fenced	1	54H	0480900-5789800
SA	Spencer's Pond	Eight-Mile Ck	NCP	V-Low (5)	2001-2	Fenced	1	54H	0483000-5790800
SA	Eight Mile Creek	Eight-Mile Ck	NCP	High (23)	2001-2	Vacant Land	1	54H	0482300-5790000
SA	Ewens Ponds	Eight-Mile Ck	NCP	V-High (73)	1980-89	Conservation Park	1	54H	0481600-5791200
SA	Eight Mile Ck (above Ewens Ponds)	Eight-Mile Ck	NCP	Unknown	1970-79	Fenced	1	54H	0481400-5791400
SA	Piccaninnie Ponds	Piccaninnie Ponds system	NCP	Unknown	Unknown	Conservation Park	1	54H	0495000-5788900

* IBRA Bioregion (version 5.1): NCP = Naracoorte Coastal Plain

Note:

Unknown¹ - refers to rivers/creeks which have not been surveyed within the last 5 years

Unknown² - refers to wetlands (which are more vulnerable to critical changes in flow regimes during the current drought conditions) which have not been surveyed within the last 2 years

Unknown³ - refers to sites where *N. obscura* populations have been recorded but for which more recent surveys have not recorded this species

Appendix 2: Priority, feasibility and estimated costs of recovery actions

Action	Description	Priority	Feasibility	Responsibility	Cost estimate					Total
					Year 1	Year 2	Year 3	Year 4	Year 5	
1	Distribution & abundance									
1.1	Survey techniques	1	100%	DSE, DEH	\$5,000	\$0	\$0	\$0	\$0	\$5,000.00
1.2	Field surveys	1	100%	DSE, DEH	\$20,000	\$21,000	\$22,050	\$23,153	\$0	\$86,203.00
2	Genetic & taxonomic status									
2.1	Genetic partitioning	2	100%	DSE, SA Museum	\$0	\$10,000	\$10,000	\$15,000	\$0	\$35,000.00
2.2	Taxonomic implications	1	100%	DSE, DEH	\$0	\$0	\$0	\$0	\$10,000	\$10,000.00
3	Habitat requirements									
3.1	Habitat investigation	1	100%	DSE, DEH	\$7,000	\$7,350	\$7,718	\$8,102		\$30,170.00
3.2	Predictive habitat model	2	90%	DSE, DEH	\$0	\$0	\$0	\$10,000	\$10,000	\$20,000.00
3.3	Habitat management strategies	2	75%	DSE, DEH	\$0	\$0	\$0	\$22,000	\$22,000	\$44,000.00
4	Manage threats									
4.1	Threat identification	1	75%	DSE, DEH	\$2,000	\$2,100	\$2,200	\$2,300	\$0	\$8,600.00
4.2	Threat abatement plan	1	100%	DSE, DEH	\$0	\$0	\$0	\$0	\$7,500	\$7,500.00
4.3	Protection and restoration	1	100%	DSE, DEH	\$0	\$0	\$0	\$0	\$5,000	\$5,000.00
4.4	Control threats	1	75%	DSE, DEH, CMAs	\$0	\$75,000	\$78,750	\$82,690	\$86,825	\$323,265.00
5	Population protection									
5.1	Public land protection	3	100%	DSE, DEH	\$0	\$0	\$10,000	\$10,500	\$0	\$20,500.00
5.2	Agency liaison	2	75%	DSE, DEH	\$0	\$3,000	\$3,150	\$3,300	\$3,450	\$12,900.00
5.3	Private land protection	1	50%	DSE, DEH	\$0	\$20,000	\$21,000	\$22,000	\$23,000	\$86,000.00
5.4	Landholder liaison	1	75%	DSE, DEH, CMAs	\$0	\$5,000	\$5,250	\$5,510	\$5,790	\$21,550.00
6	Population trends									
6.1	Standardised monitoring techniques	2	100%	DSE, DEH	\$0	\$0	\$0	\$8,000	\$8,500	\$16,500.00
6.2	Population monitoring sites	2	100%	DSE, DEH	\$0	\$0	\$0	\$10,000	\$10,500	\$20,500.00
6.3	Population monitoring	2	100%	DSE, DEH	\$0	\$0	\$30,000		\$50,000	\$80,000.00

7	Biology and ecology										
7.1	Spawning and recruitment	2	75%	DSE, DEH	\$0	\$0	\$60,000	\$63,000	\$0	\$123,000.00	
7.2	Diet	3	75%	DSE, DEH	\$0	\$0	\$0	\$10,000	\$10,000	\$20,000.00	
8	Captive population										
8.1	Establish captive population	3	75	DSE, DEH	\$0	\$0	\$0	\$30,000	\$30,000	\$60,000.00	
9	New populations										
9.1	Select sites	2	100%	DSE, DEH	\$0	\$0	\$0	\$10,000	\$10,000	\$20,000.00	
9.2	Translocation plan	2	50%	DSE, DEH	\$0	\$0	\$5,000	\$0	\$0	\$5,000.00	
9.3	Prepare site(s) and implement plan	2	50%	DSE, DEH	\$0	\$0	\$0	\$45,000	\$47,000	\$92,000.00	
9.4	Maintain and monitor	2	50%	DSE, DEH	\$0	\$0	\$0	\$15,000	\$15,750	\$30,750.00	
10	Information, education										
10.1	Community involvement	2	100%	DSE, DEH	\$5,000	\$5,250	\$5,500	\$5,800	\$6,100	\$27,650.00	
10.2	Information, extension	2	100%	DSE, DEH	\$5,000	\$5,250	\$5,500	\$5,800	\$6,100	\$27,650.00	
	Totals				\$44,000	\$153,950	\$266,118	\$407,155	\$367,515	\$1,238,738.00	

CMA – Catchment Management Authority; DEH – Department for Environment and Heritage (SA); DSE – Department of Sustainability and Environment (Vic)

Appendix 3: Native freshwater fish co-occurring with the Variegated Pygmy Perch

Victorian sites: DSE 2007a; South Australian sites: Hammer 2002

Scientific name	Common name	No. sampling events	
		Vic	SA
<i>Nannoperca australis</i>	Southern Pygmy Perch	9	6 (P)
<i>Nannoperca obscura</i> (EPBC-V)	Yarra Pygmy Perch	4 (NT, FFG)	-
<i>Anguilla australis</i>	Short-finned Eel	2	3
<i>Galaxias maculatus</i>	Common Galaxias	11	7
<i>Galaxias olidus</i>	Mountain Galaxias	3	- (C)
<i>Gadopsis marmoratus</i>	River Blackfish	17	5 (P)
<i>Galaxias truttaceus</i>	Spotted Galaxias		3
<i>Philypnodon grandiceps</i>	Flat-headed Gudgeon	9	-
<i>Prototroctes maraena</i> (EPBC-V)	Australian grayling	(V, FFG)	2
<i>Retropinna semoni</i>	Australian Smelt	3	
<i>Atherinosoma microstoma</i>	Small mouthed Hardyhead		1
<i>Mordacia mordax</i>	Short-headed Lamprey	4	
<i>Pseudaphritis urvillii</i>	Tupong	14	6

(EPBC-V) denotes species listed as Vulnerable under the federal Environment Protection and Biodiversity Conservation Act (1999)

(NT) and (V) denotes species that are classified as 'Near Threatened' and 'Vulnerable' under the Victorian DSE criteria.

(P) denotes species that are Protected under the S.A Fisheries Act 1982.

(C) denotes species that are of Conservation concern (S.A).